

FLORICEPS MINACANTHUS SP. NOV. (CESTODA: TRYPANORHYNCHIA) FROM AUSTRALIAN FISHES

by R. A. CAMPBELL* & I. BEVERIDGE†

Summary

CAMPBELL, R. A. & BEVERIDGE, I. (1987) *Floriceps minacanthus* sp. nov. (Cestoda: Trypanorhyncha) from Australian fishes. *Trans. R. Soc. S. Aust.* 111(4), 189-194, 30 November, 1987.

Floriceps minacanthus sp. nov. is described from adult worms in sharks and from plerocerci obtained from the viscera of teleosts taken in Australian coastal waters off Queensland, New South Wales and South Australia. Selachian hosts are *Carcharhinus brachyurus* (Guenther, 1870) (type host), and *C. amboinensis* (Mueller & Hanle, 1841). Plerocerci were obtained from the teleosts *Platycephalus laevigatus* Cuvier, 1829, *Plectropomus ? leopardus* (Lacépède, 1802) and *Sphyroena novaehollandiae* Guenther, 1860. Descriptions of the adult and metacestode stages are provided. Characteristics of both the adult worms and plerocerci are consistent, with the exception that the scolex of adults is more elongated than plerocerci thereby increasing the ratio of bulb length to pars vaginalis. Characters differentiating *F. minacanthus* from other species of *Floriceps* are the shape of principal hooks 1(1), shorter bulbs (<0.9 mm), ratio of pars bulbosa to pars vaginalis (almost 1:6) and genital pore in posterior ¼ of segment.

KEY WORDS: *Floriceps*, Trypanorhyncha, new species, Cestoda.

Introduction

Species of the trypanorhynch cestode genus *Floriceps* Cuvier, 1817 are common parasites of the spiral valves of sharks in many regions of the world (Dollfus 1942) with the metacestode stages (plerocerci) occurring encapsulated in the viscera of teleosts. The genus has not previously been reported from fish in Australian coastal waters (Beumer *et al.* 1982). Recent cestode collections from sharks and teleosts contain both adults and plerocerci of a new species of *Floriceps* and the description of the new species forms the basis of this paper.

Materials and Methods

Adult cestodes were removed from the spiral valves of sharks and were either killed by relaxing in tap water and fixing in 10% formal saline, or were fixed live with hot 10% formalin. Plerocerci were fixed in 10% formalin or the scoleces were dissected free, the tentacles everted by placing in fresh water, and they were then fixed in formalin or Berland's fluid. Whole mounts were stained with celestine blue, dehydrated in ethanol, cleared in clove oil and mounted in balsam. Tentacles were dissected free from scoleces, and were mounted in glycerine jelly. Measurements are presented in the text in micro-

metres, unless otherwise stated, as the range followed by the mean in parentheses. The number of measurements made is shown in the form n=. Terminology for trypanorhynch morphology follows that of Dollfus (1942). Specimens have been deposited in the South Australian Museum (SAM), Adelaide, the British Museum (Natural History) (BMNH), London, the United States National Museum Helminth Collection (USNMHC), Washington, and the Australian Helminth Collection (AHC), in SAM.

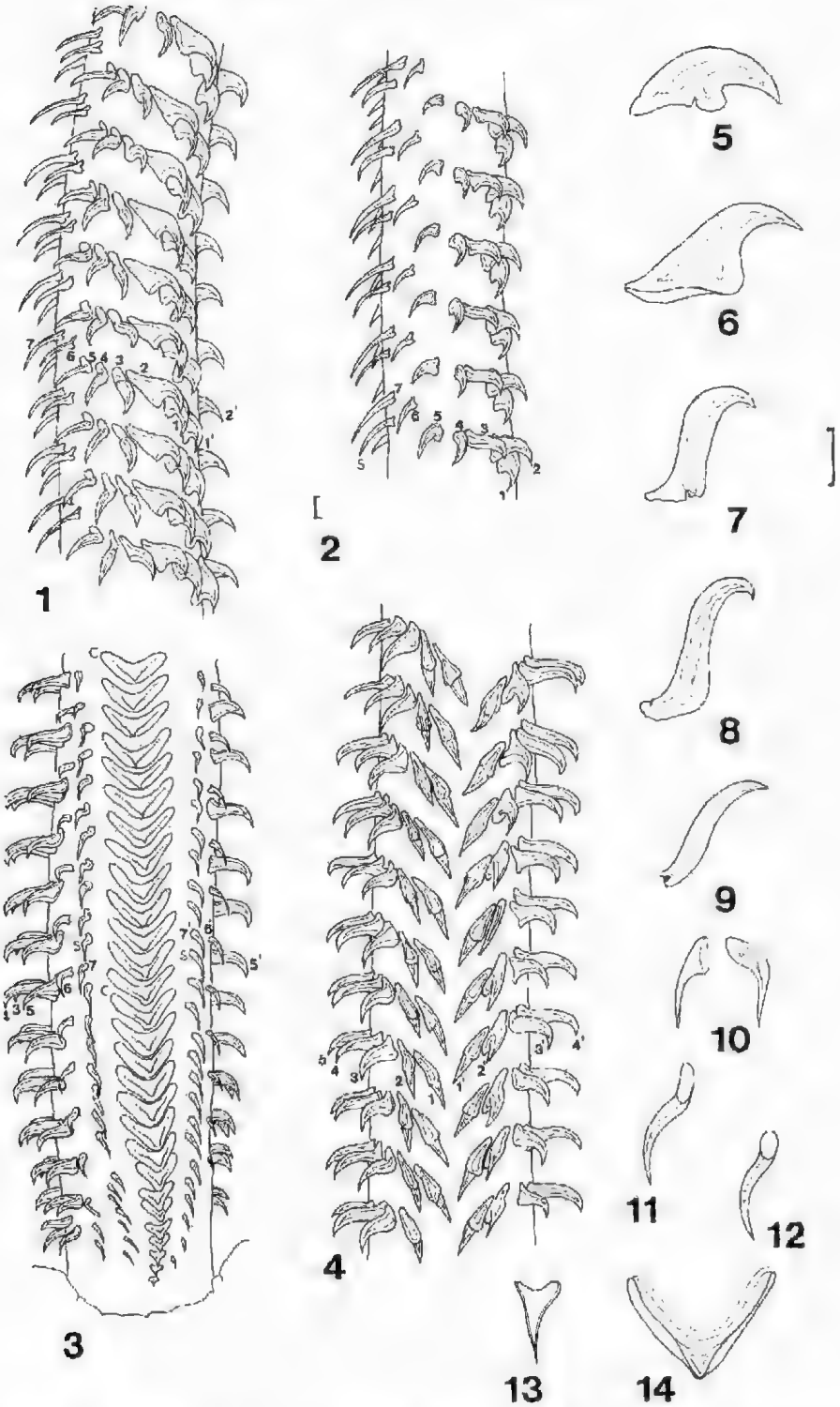
Floriceps minacanthus sp. nov.

FIGS 1-17

Description: Measurements of eight adult specimens from *Carcharhinus brachyurus* (types). Scolex and strobila slightly craspedote, strobila up to 18.5 cm long, segments hyperapolytic. Scolex length 3550-5950 (4770) (n=8), width at bulbs 800-1470 (1060) (n=8). Two bothridia, heart-shaped, each with small indentation on posterior margin, length 930-1140 (1030) (n=8) by 1300; anterior margins curled toward midline (Fig. 15). Pars vaginalis 2860-5500 (4050) (n=8), tentacle sheaths coiled; gland cells scattered in parenchyma of pendunculus scolecis. Bulbs 680-800 (720) (n=8) long, 140-250 (200) (n=8) in diameter; retractor muscle attached near posterior extremity. Pars post-bulbosa lacking. Ratio of pars bulbosa to pars vaginalis 1:4.2 to 1:7.3 (1:5.6) (n=8). Metabasal armature pocciloacanthous, with single chainette of V-shaped hooks; no basal armature. Metabasal armature consists of alternating half spiral rows of 7 hooks each; single satellite hook located posterior to seventh hook of each principal row (Fig. 3).

* Department of Biology, Southeastern Massachusetts University, North Dartmouth, Massachusetts, USA 02747.

† South Australian Department of Agriculture, Central Veterinary Laboratories, c/- Institute of Medical and Veterinary Science, Frome Road, Adelaide, S. Aust. 5000.



Figs 1-14, *Floriceps minacanthus* sp. nov. 1, 2, metabasal armature, bothridial surface; 3, basal and metabasal armature of tentacle, external surface; 4, metabasal armature, internal surface; 5-11, profiles of hooks 1, 2, 3, 4, 5, 6 and 7 respectively; 12, profile of satellite hook or hook 8; 13, chainette element from mid-tentacular region; 14, chainette element from metabasal region. Scale lines: figs 1-4, 0.1 mm; figs 5-14, 0.01 mm. Legend: bothridial hooks 1, 2 7; antibothridial hooks 1', 2' 7'; satellite hooks S; chainette C.

Hooks hollow; hooks of principal rows and chainette smallest in basal region, reaching maximum size 8 to 10 rows from base, decreasing in size beyond midlength of tentacle. Hooks 1(1') and 2(2') on inner face large, thorn-shaped; 1(1') strongly curved toward tentacle, length 21-30 (28) (n=10), base length 15-20 (19) (n=10), maximum height 10-25 (18) (n=10); hooks 2(2') erect, recurved at tip, length 24-31 (29) (n=10), base 18-20 (19) (n=10), height 15-20 (17). Hooks 3(3') to 7(7') sinuous, becoming spiniform in shape as row reaches external face; 3(3'), length 25-32 (30) (n=10), base length 10-14 (12) (n=10); 4(4') length 22-32 (29) (n=10), base length 8-11 (10) (n=10); 5(5') length 16-24 (22) (n=10), base length 5-8 (7) (n=10); 6(6') spiniform, length 16-22 (20) (n=10), base length 3-6 (5) (n=10); 7(7') spiniform, length 23-30 (28) (n=10), base length 4-6 (5.2) (n=10). Satellite hook (=hooks 8(8')) spiniform, length 18-26 (24) (n=10), base length 5-8 (6) (n=10). Chainette single, consisting of large hooks with basal winglike processes; maximum dimensions at base of tentacle, length 6-10 (8) (n=10) by 12-14 (13) (n=10); in metabasal region, width across wings 24-30 (29) (n=10) by 17.5-20 (18) (n=10). Tentacle diameter, 70-80 (75) (n=4) at base, 20-25 (21) (n=4) at midlength.

Number of segments 69-83 (n=3). Segments appear 6.0-9.5 mm posterior to scolex. First segments wider than long, rapidly becoming longer than wide with maturity. Mature segments 4200-6850 (5070) (n=10) by 1400-1700 (1550) (n=10). Testes medullary, spherical, 50-65 (60) (n=10) in diameter, filling all available space between longitudinal osmoregulatory canals and extremities of segment, including postovarian region. Testes number about 1200 per segment. Genital pores marginal, irregularly alternating, posterior, located 69-79% (73) (n=10) of segment length from anterior margin. Cirrus sac 430-570 (500) (n=10) by 200-300 (240) (n=10), containing internal seminal vesicle. External seminal vesicle absent. Vas deferens coils medially then posteriorly to level of ovary. Vagina posterior to cirrus sac. Ovary bilobed, maximum dimensions 180-260 (190) (n=10) by 200-300 (270) (n=10). Mehlis' gland ventral to ovarian isthmus; c. 50 in diameter. Vitellaria follicular, forming a layer enclosing osmoregulatory canals and reproductive organs. Uterus simple, median, extending about three-fourths of segment length.

Measurements of 7 specimens from *Carcharhinus amboinensis*: Scolex 3250-4500 (3870) (n=7), maximum width 600-1200 (830) (n=6); pars bothridialis 710-960 (870) (n=6); width of bothridia 750; pars vaginalis 2300-3340 (2930) (n=7); bulbs 650-910 (810) (n=6) long by 180-290 (220) (n=6)

in diameter; ratio of bulbs to pars vaginalis 1:2.9-1:4.5 (1:3.6) (n=7).

Plerocercii: 28 plerocercii obtained from viscera and body cavity of three species of teleost fishes. Armature and scolex features agree with adult worms from sharks. Three specimens from *Plectropomus* measured: Scolex 3000-3600 (3330) by 830-1380 (1100); bothridial length 930-1040 (970); pars vaginalis 2330-2700 (2520); bulbs 750-840 (800) by 200-250 (230); ratio of bulbs to pars vaginalis 1:2.8 to 1:3.6 (1:3.2); tentacle diameter 70 (base), 40-60 (midlength). Eight plerocercii obtained from *Platycephalus laevigatus*; measurement of 3 specimens with extended tentacles: Scolex 4320-5000 (4680) by 850-1200 (1030); bothridial length 1000-1060 (1040); pars vaginalis 3470-4050 (3740); bulbs 750-830 (800) by 140 to 220 (190); ratio bulbs to pars vaginalis 1:4.2-1:5.4 (1:4.7); tentacle diameter 70 (base), 40 (midlength). Single plerocercus from *Sphyræna novaehollandiae* Guenther, 1860: Scolex 4760; bothridial length 1010; pars vaginalis 3050; bulbs 775-800 by 170-215; ratio bulbs to pars vaginalis 1:3.8; tentacle diameter 78 (base), 60 (midlength).

Hosts and localities: adults: *Carcharhinus brachyurus* (Guenther, 1870) (type host), Tathra, N.S.W. (type locality) (5 specimens); Port Lincoln, S. Aust. (4 specimens). *C. amboinensis* (Mueller & Henle, 1841), St Lawrence, Qld. (7 specimens) (AHC S2652).

Site in host: Spiral valve.

Types: Holotype SAM V4035, 2 paratypes SAM V4036-4037; 2 paratypes USNMHC 79545, 79546; 4 paratypes AHC S2650, S2651.

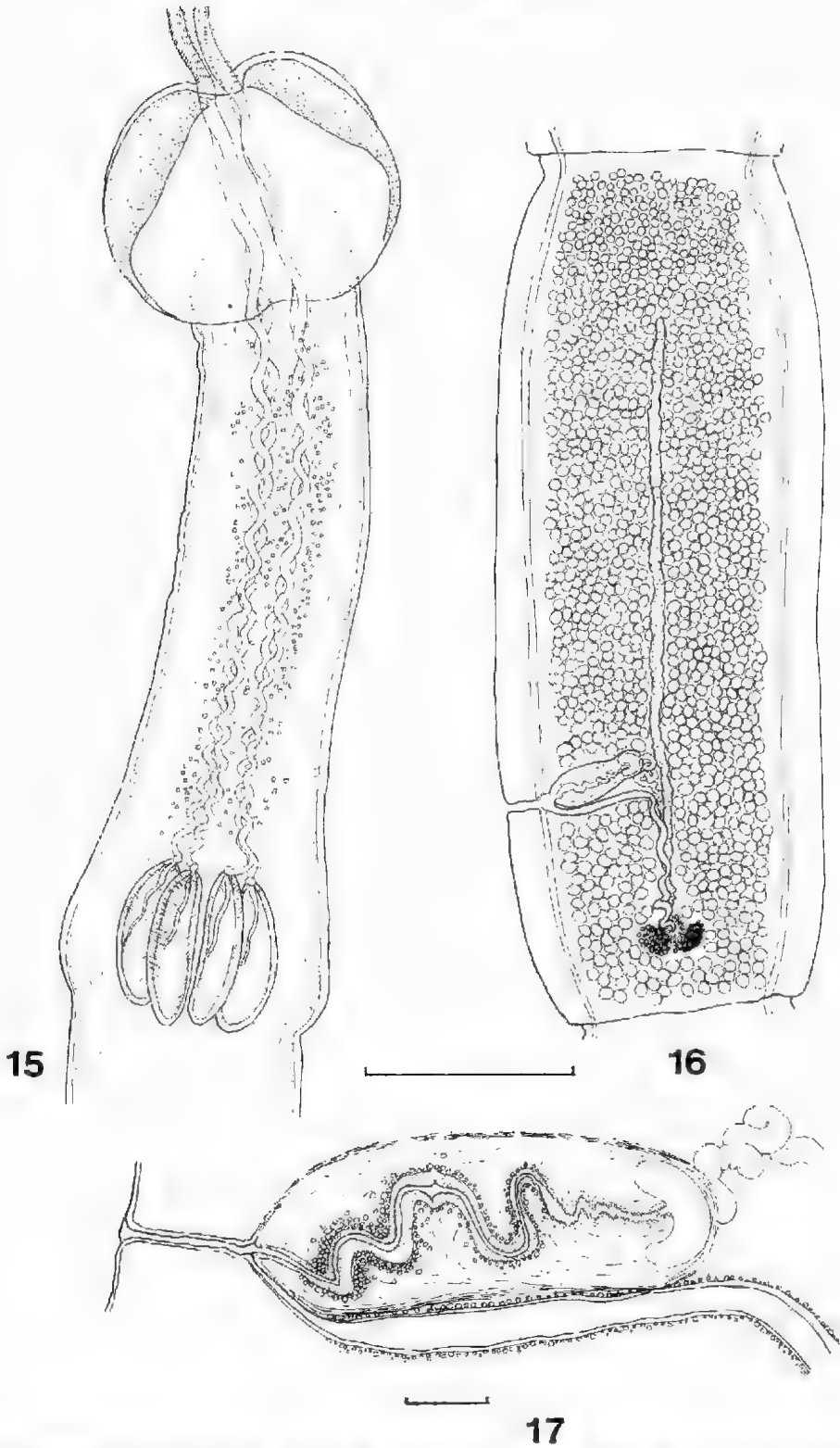
Plerocercii: From *Plectropomus? leopardus* (Lacépède, 1802), Heron Island, Qld (3 specimens) (AHC S2653); *Platycephalus laevigatus* (Cuvier 1829), Northhaven, S. Aust. (8 specimens) (SAM V4038) (BMNH 1986.10.14.2-3); *Platycephalus* sp. from fish shop, Adelaide, S. Aust. (16 specimens) (AHC S2511, 2512, 2513); *Sphyræna novaehollandiae* Guenther, 1860, Northhaven, S. Aust. (1 specimen) (BMNH 1986.10.14.1).

Site in host: serosa of viscera and in body cavity.

Etyymology: The specific name is derived from Latin, *minax*, meaning "strongly recurved" and refers to the shape of hooks 1(1').

Discussion

Schmidt (1986) listed four species belonging to the genus *Floriceps*, namely the type species, *F. saccatus* Cuvier, 1817, *F. caballeroi* Cruz-Reyes, 1977, *F. liehiae* Pintner, 1929 and *F. uxneri* Gulari, 1938.



Figs 15-17. *Flriceps minacanthus* sp. nov. 15, scolex; 16, mature proglottis; 17, cirrus sac and distal vagina. Scale lines: figs 15, 16, 1.0 mm; fig. 17, 0.1 mm.

F. saccatus differs from *F. minacanthus* sp. nov. in having hooks 1(1') and 2(2') of the same shape rather than with hooks 1(1') almost recumbent, larger bulbs (3 mm or more in length), pars bulbosa to pars vaginalis ratio of less than 1:3, and bothridia that are more triangular in shape. In contrast hooks 1(1') of *F. minacanthus* is extremely arched and almost recumbent whereas hooks 2(2') stand erect as in *F. saccatus*, the bulbs are short (900 or less), the ratio of pars bulbosa to pars vaginalis averages 1:5.6, and the bothridia are more rounded in shape.

Gland cells within the pedunculus scolecis extend from the bothridia to the anterior end of the bulbs in *F. minacanthus*; while in *F. saccatus* they are either restricted to the anterior part of the pedunculus scolecis (Dollfus 1942, figs 198, 200), or are concentrated in this region (Linton 1924, fig. 1, as *Rhynchobothrium ingens*).

A series of characters present in the mature segment may also serve to separate the two species. Yamaguti (1934) estimated that in *F. saccatus* (as *Dasyrhynchus ingens* (Linton)), 200 testes were present in a single sagittal section, compared with about 1200 per segment found in *F. minacanthus*. Even allowing for several layers of testes in *F. saccatus*, testis number may differ between the two species. In *F. minacanthus*, an internal but not an external seminal vesicle is present (Fig. 17), whereas both Linton (1921) and Yamaguti (1934) describe both vesicles as being present. Linton (1921) has the two vesicles incorrectly labelled in his figures (A and 12), while Yamaguti's figures of the external seminal vesicle are not convincing. This feature of the anatomy of *F. saccatus* should be re-investigated as it may be a further character separating the two species.

All reports of *F. saccatus* in which measurements are given, summarised by Dollfus (1942), agree in having bulbs approximately 3.0 mm long. Subhapradha (1955) however, reported "*F. saccatus*" from *Carcharhinus* sp. from Madras, in which the bulbs were 0.75 mm long and hooks 1(1') are clearly drawn as being recurved (Figs 13b, 14). This specimen is considered to be *F. minacanthus* and considerably extends the geographic range of the new species.

Cruz-Reyes (1977) provided a single view of the armature of *F. caballeroi* and his figure of the chainette (4a) shows hooks quite unlike those of *F. minacanthus*. The correct orientation and detail of the armature of *F. caballeroi* is quite unclear from his description and it needs to be redescribed before any critical assessment of its status can be made. *F. caballeroi* can be distinguished from *F. minacanthus* because the bulbs of *F. caballeroi* are long (3 mm). Cruz-Reyes (1977) described the mature segment of *F. caballeroi* as having the genital

notes in the anterior fourth of the segment, the vagina passing anterior to the cirrus sac, the uterus terminating at the level of the cirrus sac and the testes being numerous though few are shown in his drawing (Fig. 5). It is highly unlikely that the mature segment described by Cruz-Reyes (1977), which is in fact a detached segment, is that of a trypanorhynch.

Dollfus (1942; p. 395) noted that *F. lichiae* of Pintner (1929) is very similar to *Molicola horrida* (Goodsir, 1841). This means that Pintner's species possessed four bothridia unlike species of *Floriceps* which have only two (see Pintner 1929). Guiart's (1938) description of *F. oxneri* is very poor, such that it cannot be identified to any specific trypanorhynch family. The two micrographs of the plerocercus show no detail of the bothridia or armature. We consider *F. oxneri* as *incertae sedis*.

Other trypanorhynchids that have been wrongly assigned to *Floriceps* are *F. uncinatus* (Linton, 1924), *F. crassicolle* (Diesing, 1850), *F. elongatus* (Rudolphi, 1819), *F. macrocercus* (Rudolphi, 1819), and *F. granulus* (Rudolphi, 1819). Yamaguti's (1952) description and figures of *F. uncinatus* appear to be a species of *Gymnorhynchus* though he does not list the species in his subsequent synopsis of the trypanorhynchids (1959). According to Dollfus (1942) all of the remainder belong in the Gymnorhynchidae except *F. granulus* which is a synonym of *Lacistorhynchus tenuis* (Beneden, 1858).

The only major difference between adults and plerocerci of *F. minacanthus* is the increase in scolex length of the adult worms as compared to that of the plerocerci. The increased length affects the length of the pars vaginalis and accounts for the difference in the ratios of bulb length to pars vaginalis. However, the bulbs are the same size in both the plerocerci and adults and are the smallest bulbs of any species in the genus *Floriceps*.

The hook numbering system used by Dollfus (1942) for *F. saccatus* has been utilised in the above description. However, the so-called "satellite hooks", which lie immediately posterior to hooks 7(7') in *Floriceps* occur in an exactly analogous position in *Callitetrarhynchus* Pintner, 1931 and *Lacistorhynchus* Pintner, 1933, in which genera they are simply described as hooks 8(8'). There is complete homology between the hook arrangements of the metabasal armature of these three genera, and this homology could be stressed by the utilisation of a uniform system of hook numbering.

Acknowledgments

Thanks are due to B. G. Robertson, D. M. Spratt, R. G. Lester, R. A. Bray, K. J. Gowllett-Holmes and

D. C. Lee for the collection and provision of specimens described in this paper. This work was supported financially by the Australian Biological Resources Survey.

References

- BEUMER, J. P., ASHBURNER, L. D., BURBURY, M. E., JETTÉ, E. & LATHAM, D. J. (1982) A checklist of the parasites of fishes from Australia and its adjacent Antarctic territories. Technical Communication no. 48 of the Commonwealth Institute of Parasitology, Commonwealth Agricultural Bureaux, Farnham Royal, pp. 99.
- CRUZ-REYES, A. (1977) Céstodes de peces de México. II. Descripción de una nueva especie del género *Floriceps* Cuvier, 1817 (Trypanorhyncha: Dasyrhyndidae Dollfus, 1935). *Publicaciones Especiales Instituto de Biología, Universidad Nacional Autónoma de México* 4, 343-355.
- DOLLFUS, R. Ph. (1942) Etudes critiques sur les tétrarhynques du Muséum de Paris. *Arch. Mus. natl. Hist. nat., Paris* 19, 1-466.
- GUIART, J. (1938) Etude parasitologique et épidémiologique de quelques poissons de mer. *Bull. Inst. Océanogr. Monaco* No. 755, 1-15.
- LINTON, E. (1921) *Rhynchobothrium ingens* spec. nov. à parasite of the dusky shark (*Carcharhinus obscurus*). *J. Parasitol.* 8, 22-32.
- PINTNER, T. (1929) Studien ueber Tetrarhynchen nebst Beobachtungen an anderen Bandwuermen. IV. Mitteilung. Ueber einige Diesing'sche Originale und verwandte Formen. *Sitzungsber. Acad. Wiss. Wien Math. Naturwiss. Kl. Abt. I*, 138, 145-166.
- SCHMIDT, G. D. (1986) Handbook of Tapeworm Identification. CRC Press, Inc., Boca Raton, Florida. 675 p.
- SUBHAPRADHA, C. K. (1955) Cestode parasites of fishes of Madras Coast. *Ind. J. Helminthol.* 7, 41-132.
- YAMAGUTI, S. (1934) Studies on the helminth fauna of Japan. Part 4. Cestodes of fishes. *Jap. J. Zool.* 6, 1-112.
- (1952) Studies on the Helminth Fauna of Japan, Part 49. Cestodes of Fishes, II. *Acta Med. Okayama* 8, 1-76.
- (1959) *Systema Helminthum*. Vol. II. *The Cestodes of Vertebrates* Interscience Publ. Inc., New York, 860 pp.